AB

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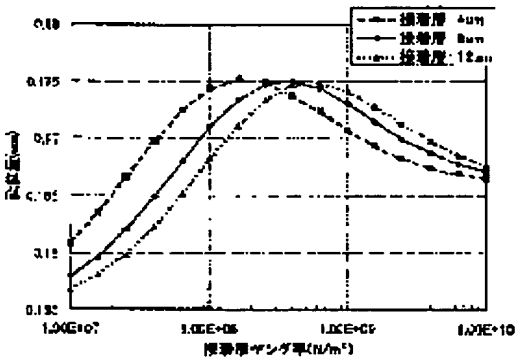
(54) PIEZOELECTRIC TYPE DRIVING BODY AND INK-JET RECORDING HEAD

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a piezoelectric type driving body and an ink jet recording head superior in displacement efficiency.
SOLUTION: In the piezoelectric type driving body having a piezoelectric element fixed to a substrate via an adhesive layer, when a film thickness of the adhesive layer is (a) (ì m) and a Young's modulus of the adhesive layer is b (N/m2), the film thickness and a material of the adhesive layer are selected to hold a relationship between the film thickness and Young's modulus of the adhesive layer of 2.0 × 10−8≤a/b≤2.6 × 108. The Young's modulus of the adhesive layer is preferably in a range of 1 × 108 to 1 × 109 (Nxm2). Moreover, the film thickness of the adhesive layer is preferably 12 (ì m) or smaller. Preferably, a Young's modulus of the substrate is 1 × 1011 (N × 102) or larger.



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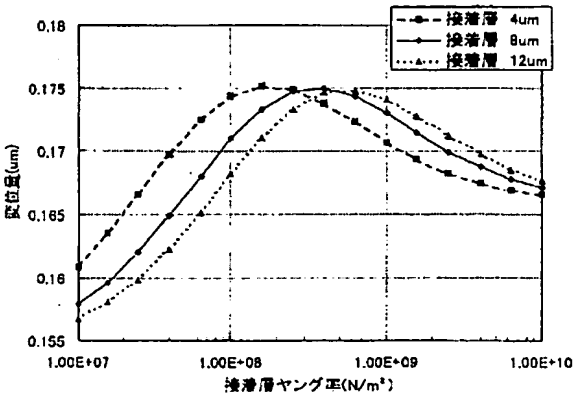
BA03 BA14

(54)【発明の名称】　圧電形駆動体及びインクジェット記録ヘッド

(57)【要約】
【課題】　本発明は変位効率の優れた圧電形駆動体及びインクジェット記録ヘッドを提供することを目的とする。
【解決手段】　接着層を介して基板に圧電素子が固定された、本発明に係る圧電形駆動体によれば、接着層の膜厚をａ（μｍ）、接着層のヤング率をｂ（Ｎ／ｍ²）とした場合、接着層の膜厚とヤング率との関係が２．０×１０⁻⁹≦ａ／ｂ≦２．６×１０⁻⁹と成り立つように、接着層の膜厚及び材質を選定する。



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【特許請求の範囲】

【請求項１】　接着層を介して基板に圧電素子が固定された圧電形駆動体において、

前記接着層の膜厚をａ（μｍ）、前記接着層のヤング率をｂ（Ｎ／ｍ²）とした場合、前記接着層の膜厚とヤング率との関係が

$2.0\times10^{-9}\leq a/b\leq 2.6\times10^{-9}$

と成り立つように、前記接着層の膜厚及び材質を選定することを特徴とする圧電形駆動体。

【請求項２】　前記接着層のヤング率は1×10^{8}（Ｎ／ｍ²）～1×10^{9}（Ｎ／ｍ²）の範囲内にある請求項１記載の圧電形駆動体。

【請求項３】　前記接着層の膜厚が１２（μｍ）以下である請求項１記載の圧電形駆動体。

【請求項４】　前記基板のヤング率は1×10^{11}（Ｎ／ｍ²）以上である請求項１～３のいずれかに記載の圧電形駆動体。

【請求項５】　インクを噴射するインクノズルに連通し、かつ充填されたインクに加圧するインク加圧室と、該インク加圧室の一部に配置され、かつ電圧パルスの印加により伸縮して前記インク加圧室の容積を増減せしめる圧電素子とを具備したインクジェット記録ヘッドにおいて、

前記圧電素子を基体に固定する接着層の膜厚及び材質は、前記接着層の膜厚をａ（μｍ）、前記接着層のヤング率をｂ（Ｎ／ｍ²）とした場合、前記接着層の膜厚とヤング率との関係が$2.0\times10^{-9}\leq a/b\leq 2.6\times10^{-9}$と成り立つように、選定することを特徴とするインクジェット記録ヘッド。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は圧電形駆動体及びインクジェット記録ヘッドに関し、特にインクジェット記録装置の記録ヘッドに用いられる圧電変位素子を基体に固定する接着層に関する。

【０００２】

【従来の技術】従来、圧電素子において圧電駆動体を固定基板に接着層を介して固定する際、その接着層に関しては、主として工法上の改良、及び応力緩和の観点で検討がなされてきた。例えば特開平１０－１００４２１号公報（以下従来例１と称す）においては、接着層の応力を緩和するための構造を提供している。具体的には、インクジェットヘッド用とした場合、接着層とその下の基板部材に切り込みを入れることによって、応力緩和を図っている。また、特開平５－７７４３１号公報（以下従来例２称す）においては、活性領域／不活性領域を含む積層型圧電動体において、基板への接着は不活性部のみを行うことにより、応力緩和及び変位特性改善を図っている。

【０００３】接着層の物性値を扱う例としては、特開平６－３０５１５５号公報（以下従来例３と称す）が挙げられる。これは接着層の厚みとヤング率の関係を示し、特性の安定化を図っている。但しこの場合は構造が限定された液滴噴射装置を対象としており、固定基板との界面の接着層を対象としてはいない。

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【０００４】圧電形駆動体は、電界によって圧電素子が分極し、これによって伸縮が発生して変位色力となることがその基本動作であるが、この伸縮によって駆動体全体が動くため、同駆動体を基板表面等に固定する接着層には応力が働く。この応力を逃し、駆動体の駆動を容易にするためには接着層の剛性は低い方が好ましい。しかし、剛性を下げ過ぎると、駆動体も接着層が吸収し、実効的な変位量が減少するようになる。よってこの最適化を図ることが望ましいが、通常はこの点は考慮されず、他の手段により変位量の増大を図っている。

【０００５】

【発明が解決しようとする課題】そこで、変位量を増大させるためには、電界を上げる、即ち印加電圧を上げる方法が最も簡便である。しかし、この場合消費電力が増大するという欠点を持つ。これを防ぐためには、積層構造として各層に電圧を印加し、かつ積層数を増やすことにより実効上の電界を上げる方法もあるが、積層数の増大は製造コストの上昇、及び素子寸法の増大につながるという問題がある。これらの点から、基本構成を変えずに、変位効率の最適化を図ることが最も望ましい。

【０００６】本発明はこれらの問題点を解決するためのものであり、圧電形駆動体の駆動効率の向上、より具体的には変位量の最適化を、固定基板に圧電形駆動体を固定する接着層によって行い、変位効率の優れた圧電形駆動体及びインクジェット記録ヘッドを提供することを目的とする。

【０００７】

【課題を解決するための手段】前記問題点を解決するために、接着層を介して基板に圧電素子が固定された圧電形駆動体における本発明によれば、接着層の膜厚をａ（μｍ）、接着層のヤング率をｂ（Ｎ／ｍ²）とした場合、接着層の膜厚とヤング率との関係が$2.0\times10^{-9}\leq a/b\leq 2.6\times10^{-9}$と成り立つように、接着層の膜厚及び材質を選定する。よって、変位特性の優れた圧電形駆動体を提供できる。

【０００８】また、接着層のヤング率は1×10^{8}（Ｎ／ｍ²）～1×10^{9}（Ｎ／ｍ²）の範囲内にあることが望ましい。更に、接着層の膜厚が１２（μｍ）以下であることが望ましい。基板のヤング率は1×10^{11}（Ｎ／ｍ²）以上であるときが更に望ましい。

【０００９】また、別の発明として、インクを噴射するインクノズルに連通し、かつ充填されたインクに加圧するインク加圧室と、該インク加圧室の一部に配置され、かつ電圧パルスの印加により伸縮してインク加圧室の容積を増減せしめる圧電素子とを具備したインクジェット

記録ヘッドによれば、圧電素子を基体に固定する接着層の膜厚及び材質は、接着層の膜厚をａ（μｍ）、接着層のヤング率をｂ（Ｎ／ｍ²）とした場合、前記接着層の膜厚とヤング率との関係が２．０×１０⁻⁹≦ａ／ｂ≦２．６×１０⁻⁹と成り立つように、選定する。よって、低消費電力で、かつ微細なインクジェット記録ヘッドを得ることができる。

【００１０】

【発明の実施の形態】接着層の膜厚をａ（μｍ）、ヤング率をｂ（Ｎ／ｍ²）とした場合、接着層の膜厚とヤング率との関係が２．０×１０⁻⁹≦ａ／ｂ≦２．６×１０⁻⁹となるように接着層の膜厚及び材質を選定する。

【００１１】

【実施例】図１は本発明の一実施例に係る圧電形駆動体の接着層ヤング率と変位量の関係を示す特性図である。同図からわかるように、接着層のヤング率を変えて変位量を測定すると、膜厚の異なる、４（μｍ），８（μｍ），１２（μｍ）の３種類の接着層毎に、あるヤング率の時に変位量は極大値を取ることが実験の結果明らかになった。

【００１２】図２は本実施例における接着層膜厚と変位量が最大となる接着層ヤング率との関係を示す特性図である。同図からわかるように、ある膜厚まではほぼ直線的に変化し、それを越えると膜厚を増やしても極大値を取るヤング率の値は変わらなくなる。この直線領域の関係をより詳細に調べると、固定基板に圧電形駆動体を固定する接着層において、その接着層の厚さをａ（μｍ）、ヤング率をｂ（Ｎ／ｍ²）とした場合、ａ／ｂの値は、２．０×１０⁻⁹以上かつ２．６×１０⁻⁹以下である。

【００１３】また、図１から、極大値を取るヤング率の値は、１×１０⁸～１×１０⁹（Ｎ／ｍ²）の範囲内に収まっていることがわかる。図２から、膜厚をこれ以上増やしても、この範囲を外れることはない。逆に膜厚を薄くすれば、この範囲から外れる可能性はあるが、工法上、及び特性上、より薄い接着層は実現的ではない。

【００１４】図２から、上述のａ／ｂの関係式が成り立つのは、概ね接着層の膜厚が１２μｍ以下の場合である。これを越えるとその関係式からは外れるが、これ以上膜厚を増やすと、最大変位量そのものが減少し、また固定強度の問題もあり、適当ではない。

【００１５】以上の接着層の特性は、固定する対象である基板の特性のとも関係する可能性があるために、実験によって調べてみた。図３にその結果を示す。同図は接着層の膜厚を８（μｍ）に固定し、接着層のヤング率と基板のヤング率を変えた場合の最大変位量を測定した結果を示すものである。これから、基板ヤング率が１．７７×１０¹¹（Ｎ／ｍ²）以上では、特性の差があまり無いが、これより低いと極端に特性が劣化することがわかる。よって、これから、基板のヤング率が概ね１×１０¹¹（Ｎ／ｍ²）以上であれば、その特性に大きな差はなくなるが、これよりも低いと極端に最大変位量が落ちてくることがわかる。以上の点から、基板のヤング率は１×１０¹¹（Ｎ／ｍ²）とすることが望ましい。

【００１６】次に、本発明は低消費電力かつ高集積の圧電形駆動体を提供することが可能となることから、インクジェット記録ヘッドへの適用が適している。以下に、本発明を、図４のような構造を有するインクジェット記録ヘッドに適用した場合の例を示す。ここで、固定基板１１上に接着層１２を介して積層された、活性領域での１４個の各圧電素子１３の厚みは３５（μｍ）となっている。また、この１４個の圧電素子からなる活性部の上下には不活性部が形成され、全体の厚みは６７５（μｍ）となっている。活性部の長さは２０００（μｍ）、幅は１００（μｍ）となっている。不活性部の長さは３００（μｍ）である。内部電極１４は厚み５（μｍ）である。圧電素子１３はｄ３３変位で、圧電定数は６．０３×１０⁻¹⁰（ｍ／Ｖ）、密度は８０００（ｋｇ／ｍ³）、ポアソン比は０．３６となっている。また、これを固定する固定基板１１は、ヤング率が１．７７×１０¹¹（Ｎ／ｍ²）、密度が５７００（ｋｇ／ｍ³）、ポアソン比が０．３となっている。このような構成で接着層の膜厚ａ及びヤング率ｂを変えて、圧電素子表面の変位量を調べた結果、そして上述した関係式（ａ／ｂ）を求めた結果を下記の表にまとめた。同表からわかるように膜厚が１２（μｍ）以下の範囲で、ａ／ｂの値が２．０×１０⁻⁹以上かつ２．６×１０⁻⁹以下であるという範囲内にあることがわかる。また、接着層の膜厚を８（μｍ）とし、接着層のヤング率と基板のヤング率を変えた場合の最大変位量を測定した場合は、図３からわかるように、基板のヤング率が１．７７×１０¹¹（Ｎ／ｍ²）以上では特性に差がないが、これより低いと極端に特性が劣化することがわかる。

【００１７】

【表１】

膜厚a	ヤング率b	a/b
4	2.00E+08	2.00E-08
6	2.51E+08	2.39E-08
8	3.16E+08	2.53E-08
10	3.98E+08	2.51E-08
12	5.01E+08	2.40E-08

【００１８】なお、本発明は上記実施例に限定されるものではなく、特許請求の範囲内の記載であれば多種の変形や置換可能であることは言うまでもない。

【００１９】

【発明の効果】以上説明したように、接着層を介して基板に圧電素子が固定された圧電形駆動体における本発明によれば、接着層の膜厚をａ（μｍ）、接着層のヤング率をｂ（Ｎ／ｍ²）とした場合、接着層の膜厚とヤング率との関係が２．０×１０⁻⁹≦ａ／ｂ≦２．６×１０⁻⁹と成り立つように、接着層の膜厚及び材質を選定する。

よって、変位特性の優れた圧電形駆動体を提供できる。

【００２０】また、接着層のヤング率は１×１０^{8}（Ｎ／ｍ^{2}）～１×１０^{9}（Ｎ／ｍ^{2}）の範囲内にあることが望ましい。更に、接着層の膜厚が１２（μｍ）以下であることが望ましい。基板のヤング率は１×１０^{11}（Ｎ／ｍ^{2}）以上であるときが更に望ましい。

【００２１】また、別の発明として、インクを噴射するインクノズルに連通し、かつ充填されたインクに加圧するインク加圧室と、該インク加圧室の一部に配置され、かつ電圧パルスの印加により伸縮してインク加圧室の容積を増減せしめる圧電素子とを具備したインクジェット記録ヘッドによれば、圧電素子を基体に固定する接着層の膜厚及び材質は、接着層の膜厚をａ（μｍ）、接着層のヤング率をｂ（Ｎ／ｍ^{2}）とした場合、前記接着層の膜厚とヤング率との関係が２．０×１０$^{-8}$≦ａ／ｂ≦＊

＊２．６×１０$^{-8}$と成り立つように、選定する。よって、低消費電力で、かつ微細なインクジェット記録ヘッドを得ることができる。

【図面の簡単な説明】

【図１】本発明の一実施例に係る圧電形駆動体の接着層ヤング率と変位量の関係を示す特性図である。

【図２】本実施例における接着層膜厚と変位量が最大となる接着層ヤング率との関係を示す特性図である。

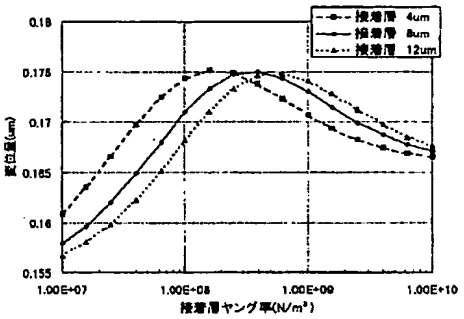
【図３】本実施例における基板ヤング率別の接着層ヤング率と変位量の関係を示す特性図である。

【図４】本発明を適用したインクジェット記録ヘッドの構造を示す断面図である。

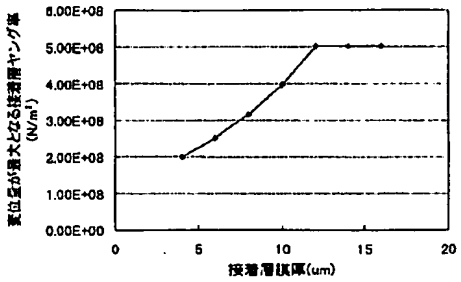
【符号の説明】

１１：固定基板、１２：接着層、１３：圧電素子、１４：内部電極。

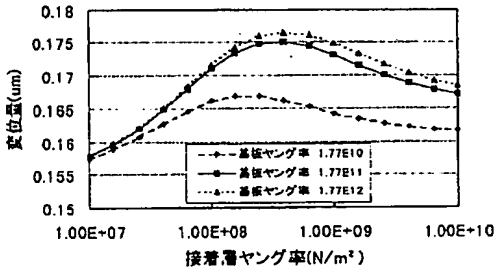
【図１】



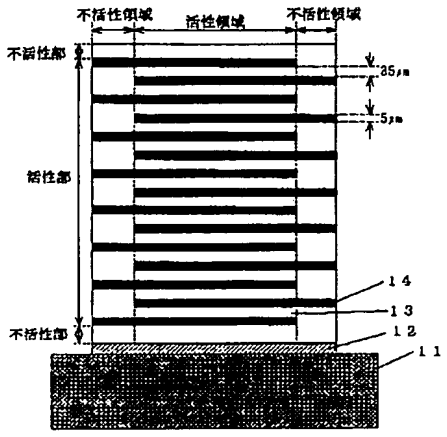
【図２】



【図３】



【図４】



JAPANESE [JP,2001-080070,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

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CLAIMS

[Claim(s)]
[Claim 1] The piezo-electric form driver characterized by selecting the thickness and the quality of the material of said glue line in the piezo-electric form driver with which the piezoelectric device was fixed to the substrate through the glue line so that the relation between the thickness of said glue line and Young's modulus may be realized with 2.0x10-8 <=a/b<=2.6x10-8 when Young's modulus of a (micrometer) and said glue line is set to b (N/m2) for the thickness of said glue line.
[Claim 2] The Young's modulus of said glue line is a piezo-electric form driver according to claim 1 which is within the limits of 1x108 (N/m2) to 1x109 (N/m2).
[Claim 3] The piezo-electric form driver according to claim 1 whose thickness of said glue line is below 12 (micrometer).
[Claim 4] The Young's modulus of said substrate is a piezo-electric form driver according to claim 1 to 3 which is more than 1x1011 (N/m2).
[Claim 5] The ink pressurized room which pressurizes the ink with which the ink nozzle which injects ink was opened for free passage and filled up, In the ink jet recording head possessing the piezoelectric device which it is arranged [piezoelectric device] in this a part of ink pressurized room, and it expands and contracts [piezoelectric device] by impression of an electrical-potential-difference pulse, and makes the volume of said ink pressurized room fluctuate The thickness and the quality of the material of a glue line which fix said piezoelectric device to a base The ink jet recording head characterized by selecting the thickness of said glue line so that the relation between the thickness of said glue line and Young's modulus may be realized with 2.0x10-8 <=a/b<=2.6x10-8 in it, when Young's modulus of a (micrometer) and said glue line is set to b (N/m2).

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] the piezo-electricity by which especially this invention is used for the recording head of an ink jet recording device about a piezo-electric form driver and an ink jet recording head -- a variation rate -- it is related with the glue line which fixes a component to a base.
[0002]
[Description of the Prior Art] In case a piezo-electric driver is conventionally fixed to a fixed substrate through a glue line in a piezoelectric device, about the glue line, examination has been made mainly in the amelioration on a method of construction, and the viewpoint of stress relaxation. For example, in JP,10-100421,A (the conventional example 1 is called below), the structure for easing the stress of a glue line is offered. When it carries out to ink jet heads, specifically, stress relaxation is planned by putting slitting into a glue line and the substrate member under it. Moreover, in JP,5-77431,A (it calls conventional example 2 below), in the laminating mold piezo-electricity dynamic body including an active region / inactive field, when the adhesion to a substrate performs only an inert segment, stress relaxation and a displacement property improvement are aimed at.
[0003] As an example treating the physical-properties value of a glue line, JP,6-305155,A (the conventional example 3 is called below) is mentioned. This shows the thickness of a glue line, and the relation of Young's modulus, and is attaining stabilization of a property. However, it is not aimed at the glue line of an interface with a fixed substrate for the drop fuel injection equipment with which structure was limited in this case.
[0004] Although it is that basic actuation for a piezoelectric device to polarize a piezo-electric form driver by electric field, and for telescopic motion to occur by this, and to become displacement ****, in order that the whole driver may move by this telescopic motion, to the glue line fixed to a substrate front face etc., stress commits this driver. In order to miss this stress and to make the drive of a driver easy, the lower one of the rigidity of a glue line is desirable. However, if rigidity is lowered too much, a glue line will also absorb a driver and the effectual amount of displacement will come to decrease. Therefore, although it is desirable to attain this optimization, this point is not taken into consideration but is usually aiming at increase of the amount of displacement with other means.
[0005]
[Problem(s) to be Solved by the Invention] So, in order to increase the amount of displacement, electric field are raised, namely, the approach of raising applied voltage is the simplest. However, it has the fault that power consumption increases in this case. Although there is also the approach of raising the electric field on efficiency by impressing an electrical potential difference to each class as a laminated structure, and increasing the number of laminatings in order to prevent this, increase of the number of laminatings has the problem of leading to the rise of a manufacturing cost, and increase of a component dimension. It is most desirable to attain optimization of displacement effectiveness from these points, without changing a basic configuration.
[0006] This invention aims at offering the piezo-electric form driver and ink jet recording head for solving these troubles which it is, more specifically performed optimization of the amount of

displacement by improvement in the drive effectiveness of a piezo-electric form driver, and the glue line which fixes a piezo-electric form driver to a fixed substrate, and were excellent in displacement effectiveness.
[0007]
[Means for Solving the Problem] In order to solve said trouble, when Young's modulus of a (micrometer) and a glue line is set to b (N/m2) for the thickness of a glue line according to this invention in the piezo-electric form driver with which the piezoelectric device was fixed to the substrate through the glue line, the thickness and the quality of the material of a glue line are selected so that the relation between the thickness of a glue line and Young's modulus may be realized with 2.0x10-8 <=a/b<=2.6x10-8. Therefore, the piezo-electric form driver which was excellent in the displacement property can be offered.
[0008] Moreover, as for the Young's modulus of a glue line, it is desirable that it is within the limits of 1x108 (N/m2) to 1x109 (N/m2). Furthermore, it is desirable for the thickness of a glue line to be below 12 (micrometer). The Young's modulus of a substrate has a still more desirable time of being more than 1x1011 (N/m2).
[0009] Moreover, the ink pressurized room which pressurizes the ink with which the ink nozzle which injects ink was opened for free passage and filled up as another invention, According to the ink jet recording head possessing the piezoelectric device which it is arranged [piezoelectric device] in this a part of ink pressurized room, and it expands and contracts [piezoelectric device] by impression of an electrical-potential-difference pulse, and makes the volume of an ink pressurized room fluctuate The thickness and the quality of the material of a glue line which fix a piezoelectric device to a base select the thickness of a glue line so that the relation between the thickness of said glue line and Young's modulus may be realized with 2.0x10-8 <=a/b<=2.6x10-8 in it, when Young's modulus of a (micrometer) and a glue line is set to b (N/m2). Therefore, it is a low power and a detailed ink jet recording head can be obtained.
[0010]
[Embodiment of the Invention] When thickness of a glue line is set to a (micrometer) and Young's modulus is set to b (N/m2), the thickness and the quality of the material of a glue line are selected so that the relation between the thickness of a glue line and Young's modulus in 2.0x10-8 <=a/b<=2.6x10-8 may become.
[0011]
[Example] Drawing 1 is the property Fig. showing the glue line Young's modulus of a piezo-electric form driver and the relation of the amount of displacement concerning one example of this invention. As shown in this drawing, when the Young's modulus of a glue line was changed and the amount of displacement was measured, it became clear at the time of a certain Young's modulus that the amount of displacement takes the maximal value as a result of the experiment three kinds of every glue lines of 4 (micrometer), 8 (micrometer), and 12 (micrometer) from which thickness differs.
[0012] Drawing 2 is the property Fig. showing relation with the glue line Young's modulus from which the glue line thickness and the amount of displacement in this example serve as max. As shown in this drawing, it changes almost linearly, and if a certain thickness exceeds it, even if it will increase thickness, the value of the Young's modulus which takes the maximal value will not change it. When the relation of this straight-line field was investigated more in the detail, thickness of that glue line is set to a (micrometer) and Young's modulus is set to b (N/m2) in the glue line which fixes a piezo-electric form driver to a fixed substrate, the values of a/b are 2.0x10 to 8 or more, and 2.6x10 to 8 or less.
[0013] Moreover, drawing 1 shows that the value of the Young's modulus which takes the maximal value has fallen within the range of 1x108 to 1x109 (N/m2). From drawing 2 , even if it increases thickness more than this, it does not separate from this range. Conversely, although it may separate from this range if thickness is made thin, a thinner glue line is not implementation-like on a method of construction and a property.
[0014] That the relational expression of above-mentioned a/b consists of drawing 2 is the case where the thickness of a glue line is 12 micrometers or less in general. although it will separate from the relational expression if this is exceeded, if thickness is increased more than this -- max -- a variation rate -- the

amount itself decreases, and there is also a problem of fixed reinforcement, and it is not suitable.
[0015] Since the property of the above glue line may have been related also to that of the property of the substrate which is the object to fix, the experiment investigated it. The result is shown in drawing 3 . the max at the time of this drawing fixing the thickness of a glue line to 8 (micrometer), and changing the Young's modulus of a glue line, and the Young's modulus of a substrate -- a variation rate -- the result of having measured the amount is shown. From now on, although there is no difference of a property not much above 1.77x1011 (N/m2), when substrate Young's modulus is lower than this, it will turn out that a property deteriorates extremely. therefore -- although the big difference in the property will be lost from now on if the Young's modulus of a substrate is more than 1x1011 (N/m2) in general, if lower than this -- extremely -- max -- a variation rate -- it turns out that an amount falls off. As for the Young's modulus of the above point to a substrate, it is desirable to be referred to as 1x1011 (N/m2).
[0016] Next, since it becomes possible [this invention] to offer a low power and the piezo-electric form driver of high accumulation, application to an ink jet recording head is suitable. Below, the example at the time of applying this invention to the ink jet recording head which has structure like drawing 4 is shown. Here, the thickness of each 14 piezoelectric device 13 in the active region by which the laminating was carried out through the glue line 12 on the fixed substrate 11 is 35 (micrometer). Moreover, an inert segment is formed in the upper and lower sides of the activity section which consists of this 14 piezoelectric device, and the whole thickness has become 675 (micrometer). The die length of the activity section is become to 2000 (micrometer), and width of face has become 100 (micrometer). The die length of an inert segment is 300 (micrometer). An internal electrode 14 is thickness 5 (micrometer). 13 isdpiezoelectric-device 33 variation rate, in the piezoelectric constant, 6.03x1010 (m/V) and a consistency are become to 8000 (kg/m3), and the Poisson's ratio has become 0.36. Moreover, 1.77x1011 (N/m2) and a consistency are become to 5700 (kg/m3), and, as for the fixed substrate 11 which fixes this, the Poisson's ratio has become [Young's modulus] 0.3. The thickness a of a glue line and Young's modulus b were changed with such a configuration, and the result of having asked for the relational expression (a/b) which investigated the amount of displacement on the front face of a piezoelectric device and which was mentioned above was summarized in the following table. It turns out that it is within limits which thickness says that the values of a/b are 2.0x10 to 8 or more, and 2.6x10 to 8 or less in the range below 12 (micrometer) as shown in this table. moreover, the max at the time of setting thickness of a glue line to 8 (micrometer), and changing the Young's modulus of a glue line, and the Young's modulus of a substrate -- a variation rate -- when an amount is measured, as drawing 3 shows, although there is no difference in a property above 1.77x1011 (N/m2), when the Young's modulus of a substrate is lower than this, it turns out that a property deteriorates extremely.
[0017]
[Table 1]

膜厚a	ヤング率b	a/b
4	2.00E+08	2.00E-08
6	2.51E+08	2.39E-08
8	3.16E+08	2.53E-08
10	3.98E+08	2.51E-08
12	5.01E+08	2.40E-08

[0018] In addition, this invention is not limited to the above-mentioned example, and if it is the publication in a patent claim, neither deformation of a variety nor a replaceable thing can be overemphasized.
[0019]
[Effect of the Invention] As explained above, when Young's modulus of a (micrometer) and a glue line is set to b (N/m2) for the thickness of a glue line according to this invention in the piezo-electric form driver with which the piezoelectric device was fixed to the substrate through the glue line, the thickness and the quality of the material of a glue line are selected so that the relation between the thickness of a glue line and Young's modulus may be realized with 2.0x10-8 <=a/b<=2.6x10-8. Therefore, the piezo-electric form driver which was excellent in the displacement property can be offered.
[0020] Moreover, as for the Young's modulus of a glue line, it is desirable that it is within the limits of

1x108 (N/m2) to 1x109 (N/m2). Furthermore, it is desirable for the thickness of a glue line to be below 12 (micrometer). The Young's modulus of a substrate has a still more desirable time of being more than 1x1011 (N/m2).

[0021] Moreover, the ink pressurized room which pressurizes the ink with which the ink nozzle which injects ink was opened for free passage and filled up as another invention, According to the ink jet recording head possessing the piezoelectric device which it is arranged [piezoelectric device] in this a part of ink pressurized room, and it expands and contracts [piezoelectric device] by impression of an electrical-potential-difference pulse, and makes the volume of an ink pressurized room fluctuate The thickness and the quality of the material of a glue line which fix a piezoelectric device to a base select the thickness of a glue line so that the relation between the thickness of said glue line and Young's modulus may be realized with 2.0x10-8 <=a/b<=2.6x10-8 in it, when Young's modulus of a (micrometer) and a glue line is set to b (N/m2). Therefore, it is a low power and a detailed ink jet recording head can be obtained.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the property Fig. showing the glue line Young's modulus of a piezo-electric form driver and the relation of the amount of displacement concerning one example of this invention.
[Drawing 2] It is the property Fig. showing relation with the glue line Young's modulus from which the glue line thickness and the amount of displacement in this example serve as max.
[Drawing 3] It is the property Fig. showing the glue line Young's modulus according to substrate Young's modulus in this example, and the relation of the amount of displacement.
[Drawing 4] It is the sectional view showing the structure of the ink jet recording head which applied this invention.
[Description of Notations]
11: A fixed substrate, 12:glue line, 13:piezoelectric device, 14 : internal electrode.

[Translation done.]